USER'S MANUAL

FOR

MODEL PCIM4

COMPUTER INTERFACE MODULE

PORTER

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FM-280 Rev. C 6/07

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PRODUCT DESCRIPTION

Porter's Computer Interface Module Model PCIM4 is a four-channel, multi-feature, modular secondary electronics package designed for use with all Porter Series 100 Mass Flowmeters (MFM's) and Series 200 Mass Flow Controllers (MFC's). Model PCIM4 includes Porter's exclusive COM-LINK feature, a two-way communicating link computer interface. Model PCIM4 also employs Automatic Proportional Tracking (APT) Mode operation, a feature which permits setting the flow rate control in one or more channels to be a fixed ratio of the flow rate control in a reference channel, regardless of the process flow rate in that reference channel.

The four input channels of Model PCIM4 accept the flow signals. These signals may be controlled by four manually-operated, 10-turn setpoint controls located on the front panel or through COM-LINK's internal circuitry (when enabled). In either case, control action occurs when the process flow value in a given channel matches its respective setpoint.

Process flow rates for all channels are displayed on a large, bright digital panel meter as a percentage of full scale. The range of this meter is from 000.0 to 102.4 percent. Manual or COM-LINK setpoints for any channel may also be displayed on the panel meter in the same percentage of full scale flow units. Setpoints are adjustable to any value in the previously stated range using the panel-mounted 10-turn adjustment controls or by a computer via COM-LINK.

Model PCIM4 is completely self-contained with internal modular construction. It has been designed with the latest high technology microcircuits, although its operation is extremely simple.

SPECIFICATIONS

Function: Processes 0 to 5 Vdc flow signal inputs from Series 100 MFM's and Series 200 MFC's to provide read-out in percentage of full scale flow and provides setpoint control action.

Inputs: Four (4) channels. Inputs (flow signal line plus common) enter instrument via connectors (CH1 through CH4) on rear panel.

Setpoints: One setpoint potentiometer per channel, adjustable from 0 to 102.4% F.S. with its respective 10-turn control, or by computer via COM-LINK inputs.

Display: Red, 3-1/2 digit, (0.56 in. high) digital panel meter with 0.1% resolution.

Electrical Connections: Four (4) 15-pin D-type connectors (one per channel) for input and output signals from MFM/MFC. One (1) auxiliary 25-pin D-type connector for remote output signal use and COM-LINK connection.

Automatic Proportional Tracking (APT) Control: Control switches located on rear panel permit fixed internal reference for all setpoint channels or selected signal references for all setpoint channels except Channel 1 (CH 1). Operational only in local mode operation.

Power Requirements: 117 VAC (+/- 10%), 50 to 60 Hz, 50 watts. Line fuse (rear panel) is rated at 0.5A Slo-Blo.

Dimensions: 8 1/2"W x 4 7/8"H x 9 3/4"D

Weight: 6 lbs.

COM-LINK INPUT/OUTPUT D.C. ELECTRICAL CHARACTERISTICS

NOTE: All COM-LINK signals reference to REM Logic common. This common is not connected to Model PCIM4 power or signal common within Model PCIM4.

READY (RDY):

1. Active low when COM-LINK ENABLE switch is in REMOTE ENABLE position; transistor open collector when COM-LINK ENABLE switch is in LOCAL ENABLE position.

2. V sat @ 1.4ma sink = .5V max
   V max. = 30V
   I max. = 50ma
   Power Dissipation = 50mw

   NOTE: RDY line has 100 Ω current limiting resistor for opto coupler protection.

REMOTE CONTROL ENABLE (REM CONT ENAB): (Channels 1 through 4):

1. Active high input when COM-LINK ENABLE switch is in REMOTE ENABLE position; inactive when COM-LINK ENABLE switch is in LOCAL ENABLE position.

2. V min = 4.5V

3. I min (@ V min = 4.5V) = 5ma

4. V max = 15V

5. I max (@ V max = 15V) = 20ma

FLOW SIGNAL OUTPUT: (Channels 1 through 4):

1. V out = 0 to 5V

2. Source resistance = 100 Ω

   NOTE: Signal referenced to corresponding channel signal common.

SETPOINT INPUT: (Channels 1 through 4):

1. V in = 0 to 5V

2. Load resistance = 10,000 Ω

   NOTE: Signal referenced to Model PCIM-4 power common.

THEORY OF OPERATION

General

Flow signals from individual MFM's and/or MFC's are processed by Model PCIM4 for digital display of flow rates in percentage of full scale and, if user-selected, APT operation of MFC's. When using MFC's, the setpoint(s), whether potentiometer or computer-generated, may also be displayed. Computer-generated setpoints are accomplished via the COM-LINK interface. These functions are accomplished by the following four (4) modular circuit assemblies:

1. Power Supply Module.
2. Signal Conditioning/COM-LINK Module.
3. Interconnect Module (includes interconnect PC board, rear panel & rear panel components).
4. Front Panel Module (includes digital panel meter, selector switches, setpoint controls and indicator lights).

Power Supply Module (Refer to schematic diagram # KB20000)

This module is comprised of a PC board and 'L'-shaped chassis, which mounts to the PC board, and an off-board power transformer. The power supply provides three regulated supplies: +5 Vdc, +15 Vdc, and –15 Vdc, plus a precise +5.120 Vdc reference supply. They operate all functional circuitry within Model PCIM4. The +5 Vdc supply is specifically intended to operate the digital panel meter.

The 117VAC primary winding of power transformer X1 is fed from the AC line cord, 1/2A line fuse, ON/OFF switch and a pair of quick disconnect-type connectors 3J3-1 and 3J3-2.

The +5 Vdc three terminal regulator, U1 (LM340-5), receives its applied voltage from the full-wave rectifier/filter CR2, CR3 and C1. Capacitor C2 serves as a transient suppressor.

Regulators U2 and U3 (LM340 and LM320) form the basis for the dual +15 and -15 Vdc supplies. The positively-oriented rectifier diodes (part of CR5) apply their full-wave voltage to filter capacitor C3. Capacitor C6 acts to suppress transients. Note the negatively-oriented rectifier diodes (part of CR5) are the counterparts of those previously mentioned. Likewise, capacitors C4 and C5 (in parallel) plus C7 are the counterparts of C3 and C6 respectively.

Regulator (U4), used to develop the precise reference voltage (5.120 Vdc), is an LM317LZ. Resistor R1 sets a value of current through R2 by virtue of the fixed voltage across it, as established by the output terminals of U4. This current determines the voltage across R2. The total voltage across R1 and R2 is approximately 5.12 volts. Adjustment potentiometer R4 and resistor R3 set the junction of R1 and R2 such that the final output voltage across filter capacitor C8 is exactly 5.120 Vdc.

Signal Conditioning/COM-LINK Module (Refer to schematic diagram # KB19707)

Several functions are accomplished by the Signal Conditioning/COM-LINK Module: 1) Multiplexing (switching) four input flow signals and their common returns into a single output meter signal; 2) Multiplexing two sets of four setpoint signals into a single output meter signal; 3) Interfacing an external computer's setpoint control signals to substitute for the manually controlled setpoints, and 4) Various 'housekeeping' operations which are necessary for proper functioning of this module as well as the overall system.

Multiplexers U1 through U3 are the heart of the automatic switching section. Each one is a type CD 4052. This is a dual 1 of 4 analog data multiplexer. In a simple sense it may be thought of as a two-pole, four position electronically-controlled switch, where each pole selects 1 of 4 inputs in its particular switch section. A two bit binary code applied to the address inputs (pins 9 and 10) determines which sets of signals are switched to the output. More specifically, flow signals are applied to the first four inputs of U3. The common return lines for these same flow signal levels are applied to the next four inputs of this same IC (U3). A given signal and its common are selected and fed to the input of multiplexer U1.

Four local (manually-controlled) setpoints, as well as four remote (computer-controlled) setpoints, are selected by multiplexer U2 on its first group of four and second group of four inputs, respectively. Its address code inputs (pins 9 and 10) are operated by the same code lines which control U3's input switching. The front panel CHANNEL SELECT switch determines this code, thus selecting one local and one remote setpoint signal to be fed to multiplexer U1's input. Note that the common return for all local and remote

setpoint signals is the standard power supply common buss. Details of all binary switching code signals will be discussed later.

Thus far, we have seen that a particular flow signal level along with its common return line have been selected by U3, and one local plus one remote setpoint signal have been selected by U2, and these sets of signals have been presented to U1's input. Accordingly, the front panel display FUNCTION lever-type switch is used to select the FLOW signal (at its center position) or LOCAL setpoint at its one extreme position or the REMOTE setpoint at its other extreme. This action is accomplished by its own two bit binary code applied to the address inputs (pins 9 and 10) of U1. This IC (U1) switches the digital panel meter's display from a flow signal to a setpoint signal (local or remote). Also note that both the local setpoint signals, which enter the module by connector 2J5, as well as the remote setpoints, which enter via connector 2J7, go to the 'outside world'. This means that they are fed from the stated location out to their respective MFC's via relay contacts of K1 through K4 and connector 2J1.

Let us consider the working of the binary switching code for multiplexers U1 through U3, which is defined in the chart of Table 1. Keep in mind that switching code inputs A and B (pins 10 and 9) relate to binary weighting columns 2^0 and 2^1 respectively. An example of flow signal plus its common selection is given for multiplexer U3. Another example for flow or local setpoint selection is given for multiplexer U1.

TABLE 1: SWITCHING CODE FOR IC MULTIPLEXERS U1 TO U3

FUNCTION	CHANNEL NO.	BINARY CODE		IC PIN
		B, PIN 9	A, PIN 10	
FLOW SIGNAL (U3)	1	0	0	1
	2	0	1	5
	3	1	0	2
	4	1	1	4
FLOW COM (U3)	1	0	0	12
	2	0	1	14
	3	1	0	15
	4	1	1	11
LOCAL SP (U2)	1	0	0	1
	2	0	1	5
	3	1	0	2
	4	1	1	4
REMOTE SP (U2)	1	0	0	12
	2	0	1	14
	3	1	0	15
	4	1	1	11
FLOW (U1)	-	1	1	4
+ COM (U1)	-	1	1	11
LOCAL SP (U1)	-	0	1	5
+ COM (U1)	-	0	1	14
REMOTE SP (U1)	-	1	0	2
+ COM (U1)	-	1	0	15

Suppose a binary code of 10 is applied to the address inputs of U3 by the CHANNEL SELECT switch. First look at the chart of Table 1 and then check the two poles of the CHANNEL SELECT switch. It can be seen that channel 3's flow and common are being selected because switch pole 1 holds input A (pin 10) at ground. Input B (pin 9) is held high (+12V) by its 10K pull-up resistor.

Leaving the FUNCTION switch in its center or FLOW position produces a binary code of 11 at U1's address inputs by virtue of both pull-up resistors being active. However, when the display FUNCTION switch is pressed to its LOCAL SP position, the address code changes to 10 at B and A respectively. The FUNCTION switch now holds B at ground while A is held high (+12V) by its 10K pull-up resistor.

Let us presume a flow signal has been selected by IC U1. The 5 Vdc maximum flow signal at the output of unity gain buffer U4A is divided down to a 1 Vdc (maximum) signal by resistors R3 and R4. The common return line reference level for flow signal is fed from unity gain buffer U4B to a resistor network consisting of R1, R2 and zero control R6. This control (R6) adjusts the common return line level to exactly zero volts with no flow signal applied. Signals present between the two output lines are applied to the digital panel meter via connector 2J4.

Op-amp U4C serves as an inverting amplifier with a gain of X1 to convert its +5.12 Vdc input signal to a -5.12 Vdc output level. Both polarities of 5.12 Vdc are required for zero control R6. Op-amp U4D is connected as a unity gain buffer to apply a +12 Vdc level, divided down from +15 Vdc by resistors R10 and R11, to CMOS multiplexers U1 through U3 as Vcc. Connector 2J2 supplies the various power supply voltages to the Signal Conditioning/COM-LINK PC board, which are carried through to connector 2J3, for application to field-located MFM's and/or MFC's.

The COM-LINK section of this module consists of five optical isolators U5 through U9, the control relays associated with four of these isolators (K1 through K4) and the four front panel LED indicators, labeled on the schematic CH1 through CH4. Computer signals enter the equipment through the rear panel AUX connector (1J5). These signals are light beam-coupled from internally included LED's (U6 through U9) to phototransistors. Each relay is wired into an emitter-follower circuit arrangement. Notice however, that the common return line of these circuits do not return to power supply common directly. Instead, this connection is completed by the COM-LINK enabling switch on the front panel.

Consider the COM-LINK switch has been set to REMOTE ENABLE. As a result, an isolated control signal is sent to the computer via U5 informing it that it may take command of any setpoint in channels 1 through 4. Presume computer signals are applied to CH1 and CH3. Relays K2 and K3 are energized by U8 and U7 respectively. A portion of K2's current (drawn by U8) will flow through the front panel CH2 COM-LINK indicator light (I2). The same is true for indicator light I3. The most important function which takes place, however, is the relay contacts of K2 and K3 switch from the local CH1 and CH3 setpoints which enter the module on connector 2J7. In other words, the computer is now controlling the setpoints for CH2 and CH3 MFC's.

Interconnect Module (Refer to schematic diagram # KB19704)

All signals to and from the 'outside world' are made via the Interconnect Module. Therefore, consider this module as an input/output PC board with attached connectors and switches, mounted to the back panel.

Four sets of input/output signals are available on the 26-pin connector 1J6. Each set relates to a given channel. They include: 1) a 0 to 5 Vdc flow input signal; 2) its common return; 3) the setpoint output signal and 4) an auxiliary control input. Also note four slide switches, SW1 through SW4, are present in the schematic and are located on the back panel. Further, note these switches allow the setpoint lines to be connected to the internal 5.120 Vdc reference voltage or to the output signal of channel 1 (channels 2, 3 and 4) or channel 3 (channel 4 only). Channel 1, of course, is always referenced to the internal 5.120 Vdc reference voltage. The possible combinations for referencing are as follows: CH2 to CH1, CH3 to CH1, CH4 to CH1, or CH4 to CH3. This arrangement relates to the APT Mode control feature discussed in various sections of this manual.

The four individual channel input/output connectors (1J1 through 1J4) located on the rear panel are designated CH1, CH2, etc., and connect to the previously mentioned 26-pin connector 1J6 via circuit paths on the Interconnect PC board. The +15 Vdc and -15 Vdc supplies, along with the +5.120 Vdc reference voltage, enter the Interconnect PC board via connector 1J7 and exit via 1J1 through 1J4.

Connector 1J5 is designated AUX and is mounted on the rear panel. It supplies input (COM-LINK) setpoint signals plus 0 to 5 Vdc flow

signals to external meters, recorders, etc., when required. The last items to be noted here are the ON/OFF power switch and power line FUSE, also located on the rear panel.

Front Panel Module (Refer to schematic diagram # KB19707)

The digital panel meter, CHANNEL SELECTOR switch, display FUNCTION (flow, local setpoint, remote setpoint) switch, COM-LINK enabling switch and SETPOINT controls (CH1 through CH4), along with their respective cable/connector assemblies, make up the Front Panel Module.

The actual range of the digital panel meter is zero to 1.999 Vdc. Shifting the decimal point two places to the right enables the meter to read 100.0% for a 1.000 Vdc flow signal input. The CHANNEL SELECTOR switch is a four position, two pole, rotary switch which establishes a two column binary code (2^2 and 2^0) to program the appropriate coding inputs on IC U3 of the Signal Conditioning/COM-LINK Module. The FLOW/SETPOINT push-button switch selects flow signals (binary 1 in the 2^2 column) or setpoint levels (binary 0 in the 2^2 column). Setpoint potentiometers are 10-turn controls which provide a continuous 0 to 5.120 Vdc level to the inputs of IC U2 noted above, as well as the field-located MFC's. Keep in mind the 5.120 Vdc divided down 5:1 equals 1.024 Vdc, which in turn, equals a displayed value of 102.4% on the digital panel meter. Refer to the theory discussion on the Signal Conditioning/COM-LINK Module for further details.

OPERATION OF EQUIPMENT

General Information

As previously mentioned, the Porter Computer Interface Module, Model PCIM4, is used to provide a digital display of flow signals for Porter Series 100 MFM's, or to provide both flow signal digital display and setpoint control action for Porter's Series 200 MFC's.

Control action of the Model PCIM4 may take place in the Normal Mode or APT (Automatic Proportional Tracking) Mode. Normal mode occurs when the setpoint control in each channel is connected to a precise and fixed internal reference voltage. The SETPOINT Control is then adjusted to a control point given as a percent of full scale flow.

APT Mode occurs when one or more setpoint controls are connected, not to the internal reference voltage, but to a selected channel's signal output. This scheme permits automatic proportional tracking of the flow signals. In other words, if Channel 2's setpoint control is connected to Channel 1's signal output, then Channel 2's flow rate control becomes a fixed ratio of Channel l's flow rate, even if Channel 1's flow rate falls below its control limits.

Normal Mode Operation

Make sure the Norm/APT slide switches on the rear panel are set to the left side or the solid line and reference arrows marked 'REF FOR INDEP CONT.' Set the CHANNEL SELECTOR switch to the desired channel and read the digital panel meter for the process flow signal's percent of full scale flow. Set the FUNCTION (FLOW/SETPOINT) lever switch to display that channel's local setpoint in percent of full scale flow.

If it is desired to change the setpoint, adjust the desired SETPOINT control located on the right side of the front panel until the desired setpoint value is displayed on the digital panel meter.

APT Mode Operation

First, read the explanation offered for APT (Automatic Proportional Tracking) Mode Operation given in the third paragraph under the heading entitled 'General Information' (above), if you have not already done so. Now set the selected Norm/APT slide switch(es) so that the channel(s) which is(are) to 'follow' or 'track' a given reference channel is(are) set to the right side or to the dotted line(s). Considering that Channel 1 is the prime reference (always having its setpoint control connected to the internal reference voltage), Channel 2 may be switched to 'track' Channel 1; Channel 3 may be switched to 'track' Channel 1, and Channel 4 may be switched to 'track' Channel 1 or Channel 3 (a secondary reference channel).

The important thing to remember when establishing APT Mode operation is to follow the dotted lines associated with the slide switches. These lines indicate which channel is 'tracking' a particular reference channel. Also note that switching the display FUNCTION (FLOW/SETPOINT) lever switch when the CHANNEL SELECTOR switch is set to display, the channel using APT mode operation will now make the panel meter display a given ratio of the referenced channel's flow signal. That ratio is, of course, determined by the setting of the particular SETPOINT control switched into the APT Mode,

and will be read on the panel meter as a percentage of a percentage.

Example: Model PCIM4 is being operated in the APT Mode with Channel 2 ‘tracking' Channel 1. Channel 1's SETPOINT Control is adjusted to 50.0 percent of full scale flow. Channel 2's SETPOINT Control is adjusted to 80.0 percent of Channel 1's controlled flow. This means that Channel 2's flow rate should be controlled at 40 percent of full scale flow. In addition, Channel 4 can track Channel 3 in the same manner. The major advantage of APT Mode operation in this case is that even if the flow rate in Channel 1 falls below its control limits, Channel 2's flow rate will remain a fixed ratio or proportion (80 percent) of Channel 1's flow rate.

COM-LINK Operation

Set the COM-LINK enabling switch to the REMOTE ENABLE position. The COM-LINK indicator lights will show which channels the interfaced computer has chosen to control. Let us assume only CH1 and CH3 indicator lights are illuminated, indicating CH1 and CH3 setpoints are computer controlled.. This means the setpoints for channels 2 and 4 are being supplied by the CH2 and CH4 10-turn SETPT pots on the front panel,

If the computer has a major problem or power failure (assume different power sources for Model PCIM4 and computer), setpoint control for CH1 and CH3 as given in the example above will revert to LOCAL front panel SETPT potentiometers for the channels in question. This feature makes COM-LINK's operation ‘fail-safe'.

APT and COM-LINK Operation

Combining APT and COM-LINK operational features requires no special manipulation of controls. Simply follow the operating description given previously for each one individually. The major difference will be that the computer is controlling some or all of the setpoints rather than the manually controlled front panel 10-turn SETPT potentiometers. Obviously, the computer must be pre-programmed for this task with APT operation taken into account.

Verification of Calibration

Model PCIM4 is shipped precisely calibrated and ready to use. You may check calibration using the digital panel meter, if desired. Proceed as follows: Set the CHANNEL SELECTOR switch to CH1. Rotate Channel l's SETPOINT control fully clockwise. Set the FUNCTION (FLOW/SETPOINT) lever switch to LOCAL SP. The digital panel meter should display 102.4 percent.

Digital Meter Adjustment

If the digital panel meter reading obtained in the procedure above is not correct, you may assume the meter has 'drifted' slightly, since the reference supply, the basis for the equipment's calibration, is considered extremely accurate and stable (unless it is malfunctioning). Therefore, proceed as follows: 1. ‘Pop' off the meter's red plastic filter/bezel. This can be done by placing a small, thin screwdriver blade under the recess at the bottom center of the filter/bezel. 2. With CHANNEL SELECTOR switch set to CH1 and Channel 1's setpoint control fully clockwise, switch the FUNCTION (FLOW/SETPOINT) lever switch to LOCAL SP. 3. Adjust the meter calibration potentiometer, R14 (located to the right of the display digits) until the meter indicates 102.4%. 4. Replace bezel.

Equipment Calibration

This procedure should not be necessary, but may be conducted if there is reason to believe the equipment is, or may be, out of calibration. Calibration of Model PCIM4 simply means adjusting the +5.120 Vdc reference supply for +5.120 Vdc (+/- .002 Vdc). Proceed as follows: 1. Remove upper cover of the enclosure (housing). 2. Connect A/C power cord and turn unit on. 3. Locate the Channel 1 setpoint control on the back of the front panel module. Using a 4-1/2 digit, .05% accurate digital voltmeter, connect the positive (red) test probe to terminal lug # 3 of the setpoint control and the negative (black) test probe to terminal lug # 1 of the setpoint control. 4. Locate potentiometer R4 on the ‘L’-shaped power

supply module (refer to Power Supply P.C. Board Assembly drawing # KB20001). Adjust potentiometer R4 until the voltmeter reads 5.120 Vdc (+/-.002 Vdc). 5. Perform 'Verification of Calibration' and 'Digital Panel Meter Adjustment'. Calibration is now complete.

TABLE 2: REAR PANEL CONNECTORS PIN FUNCTION

Connector # CH1, CH2, CH3 and CH4

PIN NO.	FUNCTION
1	Cable Shield
2	0-5 Vdc Setpoint
3	Flow Signal Common
4	Circuit Common
5	Flow Signal Output
6	Circuit Common
7	+15 Vdc Power
8	No Connection
9	-15 Vdc Power
10-15	No Connection

Auxiliary (AUX) Connector

PIN NO.	FUNCTION	CHANNEL
1	Flow Signal Output	1
2	Flow Signal Common	1
3	Flow Signal Output	2
4	Flow Signal Common	2
5	Flow Signal Output	3
6	Flow Signal Common	3
7	Flow Signal Output	4
8	Flow Signal Common	4
9	0-5 Vdc Remote Setpoint	1
10	0-5 Vdc Remote Setpoint	2
11	0-5 Vdc Remote Setpoint	3
12	0-5 Vdc Remote Setpoint	4
13	Circuit Common	-----
14	No Connection	-----
15	Remote Enable Ready (RDY)	-----
16	Remote Control Enable (REM CONT ENAB)	1
17	Remote Control Enable (REM CONT ENAB)	2
18	Remote Control Enable (REM CONT ENAB)	3
19	Remote Control Enable (REM CONT ENAB)	4
20	Remote Logic Common	-----
21-25	No Connection	-----

POLICIES

PRICES

All prices are F.O.B. Hatfield, PA, and subject to change without notice. All merchandise will be invoiced at prices in effect at time of shipment. Prices do not include insurance, freight, taxes or special handling. These charges, if applicable, will be shown separately on invoice. Minimum order $30.00.

PAYMENT TERMS

Net 30 days after invoice date. All invoices past due are subject to a finance charge of 1½% per month (18% annual rate).

SHIPMENTS

Shipment of merchandise shall at times be subject to credit approval and will be contingent upon fires, accidents, emergencies, acts of God or any other causes which are beyond Porter Instrument Division's control.

Specifications and dimensions subject to change.

CANCELLATIONS

No cancellations will be accepted on non-standard or special merchandise, except by payment of full purchase price. If buyer requests cancellation of any order or part thereof, and is agreed to by Porter Instrument Division in writing, buyer will be subject to cancellation charges to cover the cost of material and/or fabrication incurred by Porter Instrument Division to date of cancellation.

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A minimum of 90 days notice is required on all changes to orders and will be subject to rescheduling as a new order at Porter Instrument Division's discretion.

RETURNS

No returns will be accepted unless authorized in writing by Porter Instrument Division and accompanied by a properly completed Returned Goods Authorization. All returns are subject to restocking and possible rework charges to be determined by Porter Instrument Division.

CERTIFICATE OF WARRANTY

THIS WARRANTY IS GIVEN IN PLACE OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE. NO PROMISE OR STATEMENT MADE BY ANY REPRESENTATIVE OR AUTHORIZED DEALER OF PARKER HANNIFIN CORP. SHALL CONSTITUTE A WARRANTY BY PARKER HANNIFIN CORP.

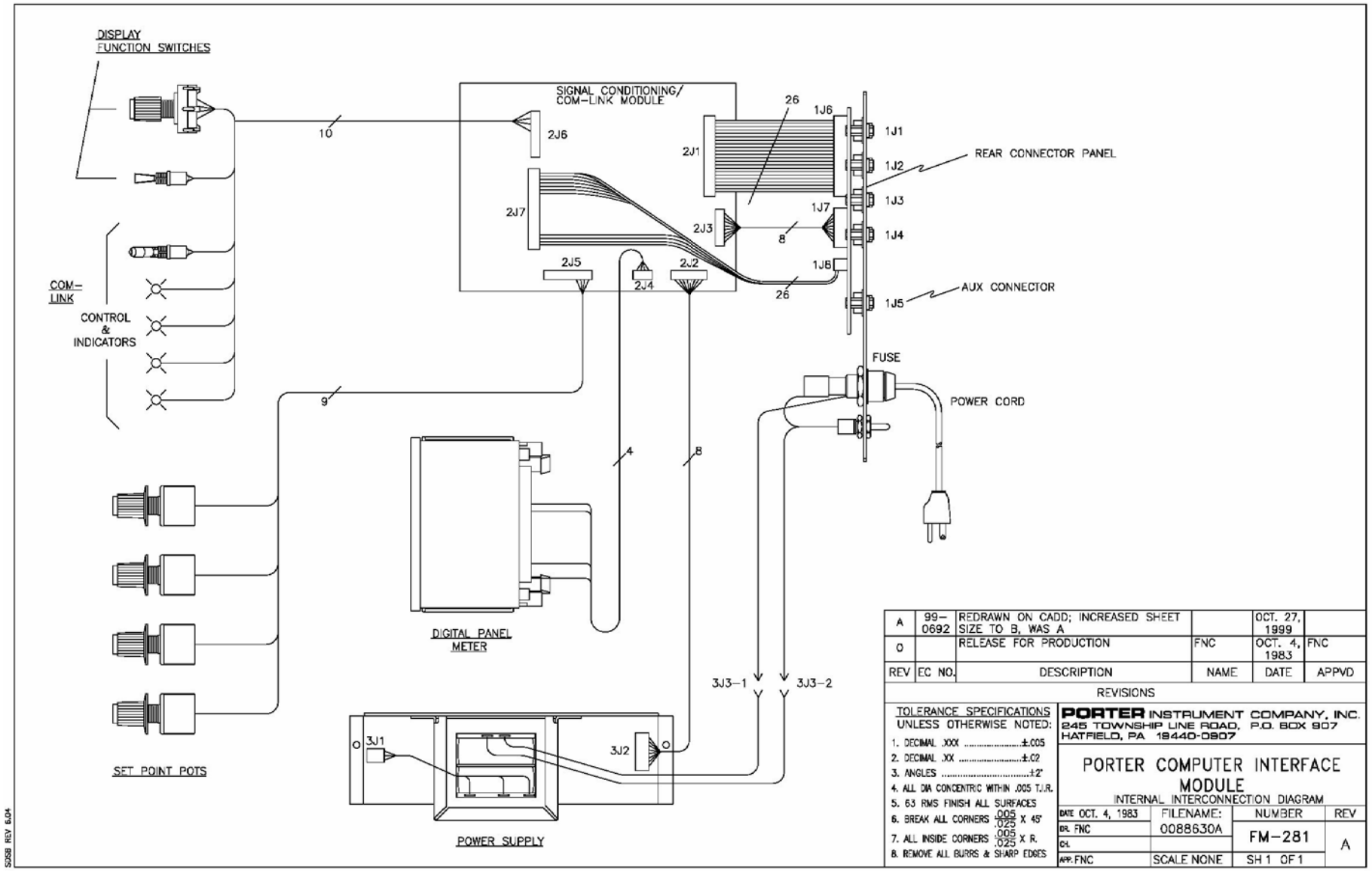
Parker Hannifin Corporation, Porter Instrument Division, warrants this equipment to be free from defects in workmanship and materials, when used in accordance with applicable specifications and with appropriate maintenance, for one (1) year from date of delivery to the customer, unless otherwise specified in writing.

Equipment which malfunctions may be returned, shipment prepaid, to Parker Hannifin Corporation, Porter Instrument Division, for test and evaluation. Equipment determined to be defective and in warranty will be repaired or replaced at no charge to the customer. Equipment out of warranty will be evaluated, and if the equipment does not meet original specifications and calibration, the customer will be notified of the costs before proceeding with repair or replacement. Repaired equipment will be warranted ninety (90) days from date of delivery to the customer or for the balance of the original warranty, whichever is longer.

Failures due to shipping damage, accident, misuse, improper mechanical or electrical installation or operation, or internal clogging or corrosion due to use of contaminated fluids or inadequate system purging are excluded from warranty coverage.

Parker Hannifin Corporation's obligation for breach of this warranty, or for negligence or otherwise, shall be strictly and exclusively limited to the repair or replacement of the equipment. This warranty shall be void as to any equipment on which the serial number, if applicable, has been altered, defaced, or removed. Parker Hannifin Corporation shall under no circumstances be liable for incidental or consequential damages.

No other promise or statement about the equipment by any representative or authorized dealer of Parker Hannifin Corporation shall constitute a warranty by Parker Hannifin Corporation or give rise to any liability or obligation of Parker Hannifin Corporation.



REV	EC NO.	DESCRIPTION	NAME	DATE	APPVD
A	99-0692	REDRAWN ON CADD; INCREASED SHEET SIZE TO B, WAS A		OCT. 27, 1999	
0		RELEASE FOR PRODUCTION	FNC	OCT. 4, 1983	FNC

REVISIONS

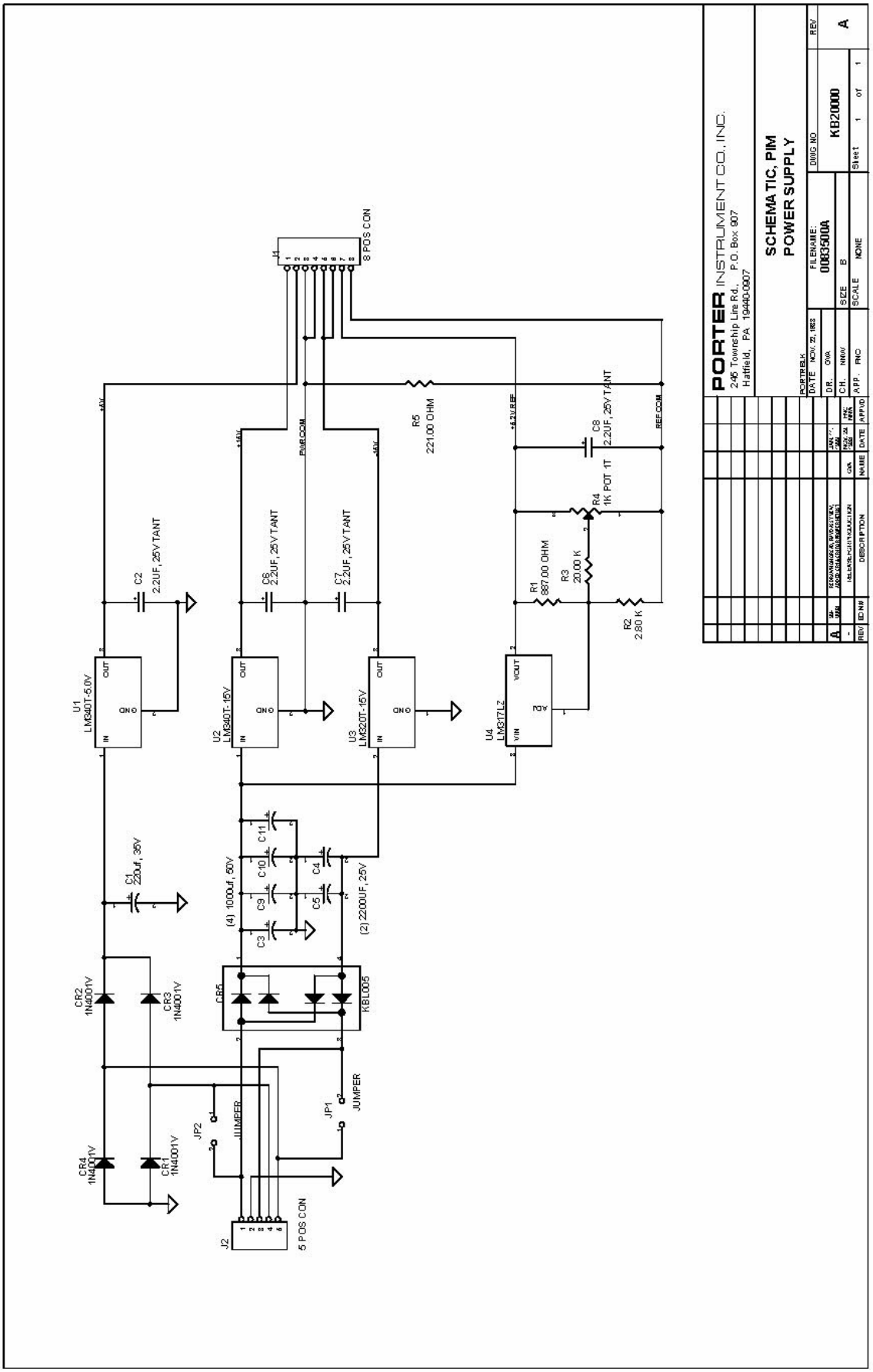
TOLERANCE SPECIFICATIONS
UNLESS OTHERWISE NOTED:
1. DECIMAL .XXX ..... ±.005
2. DECIMAL .XX ..... ±.02
3. ANGLES ..... ±2°
4. ALL DIA CONCENTRIC WITHIN .005 T.I.R.
5. 63 RMS FINISH ALL SURFACES
6. BREAK ALL CORNERS .005/.025 X 45°
7. ALL INSIDE CORNERS .005/.025 X R.
8. REMOVE ALL BURRS & SHARP EDGES

PORTER INSTRUMENT COMPANY, INC.
245 TOWNSHIP LINE ROAD, P.O. BOX 907
HATFIELD, PA 19440-0907

PORTER COMPUTER INTERFACE MODULE

INTERNAL INTERCONNECTION DIAGRAM

DATE OCT. 4, 1983	FILENAME:	NUMBER	REV
DR. FNC	0088630A	FM-281	A
CH.			
APP. FNC	SCALE NONE	SH 1 OF 1	


PORTER INSTRUMENT CO., INC.
245 Township Line Rd., P.O. Box 907
Hatfield, PA 19440-0907
SCHEMATIC, PIM
POWER SUPPLY
FILENAME: 0083500A
DWG NO KB20000
REV A
SIZE B
SCALE NONE
Sheet 1 of 1
8 POS CON
5 POS CON
U1 LM340T-5.0V
U2 LM340T-15V
U3 LM320T-15V
U4 LM317LZ
C1 220uf, 35V
C2 2.2UF, 25V TANT
C3 C4 C5 C9 C10 C11 (4) 10000uf, 50V
C6 2.2UF, 25V TANT
C7 2.2UF, 25V TANT
C8 2.2UF, 25V TANT
(2) 22000UF, 25V
CR1 1N4001V
CR2 1N4001V
CR3 1N4001V
CR4 1N4001V
CR5 KBL005
R1 887.00 OHM
R2 2.80 K
R3 20.00 K
R4 1K POT 1T
R5 221.00 OHM
JP1 JUMPER
JP2 JUMPER
+5V
+15V
-15V
+4.21V REF
POWER COM
REF COM

PROPRIETARY NOTICE

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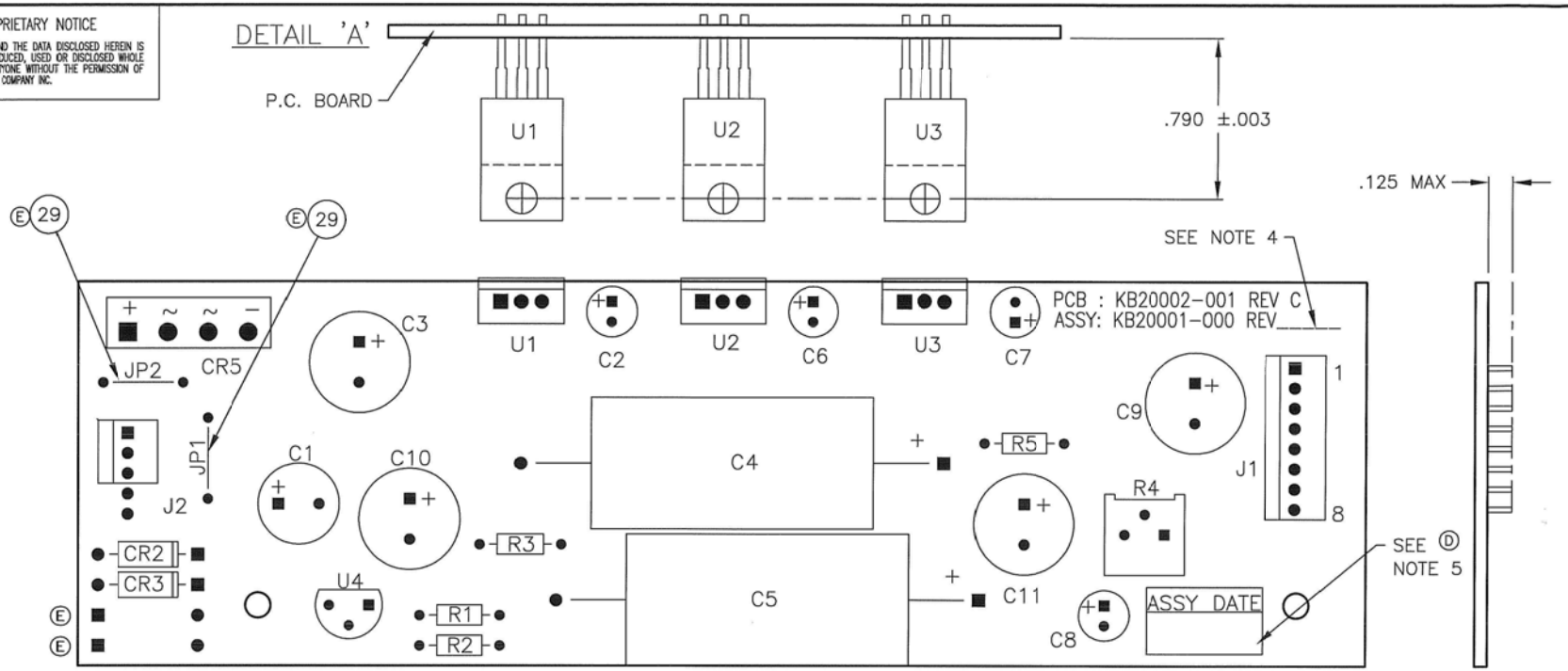


NOTES:

(E) 1.
(E) 2.
3. ASS'Y VIEWED FROM COMPONENT SIDE.
4. PERMANENTLY MARK REVISION LEVEL OF THIS DWG, IN SPACE GIVEN, USING WHITE EPOXY INK, CHARACTERS TO BE 1/16" HIGH, MIN.
(D) 5. PERMANENTLY MARK ASSY DATE IN SPACE GIVEN, USING WHITE EPOXY INK, CHARACTERS TO BE 1/16" HIGH, MIN.
(F) 6. USE FIXTURE EA-013 WHEN INSTALLING U1, U2, & U3.

REV	EC NO.	DESCRIPTION	NAME	DATE	APPVD
G	05-0348	SHT. 2: ITEM 11 WAS KA16752	MEK	MAY 25, 2005	WHK BTON
F	04-0842	ADDED NOTE 6	MAM	OCT. 5, 2004	WHK FNC
E	99-0689	REMOVED ITEM 27 & 28; ADDED ITEM 29; REMOVED NOTES 1 & 2; CHANGED ITEM BUBBLES FOR ITEM 27 & 28 TO ITEM 29;REMOVED CR1 & CR4 FROM DWG	AEM	OCT. 21, 1999	FNC BTT

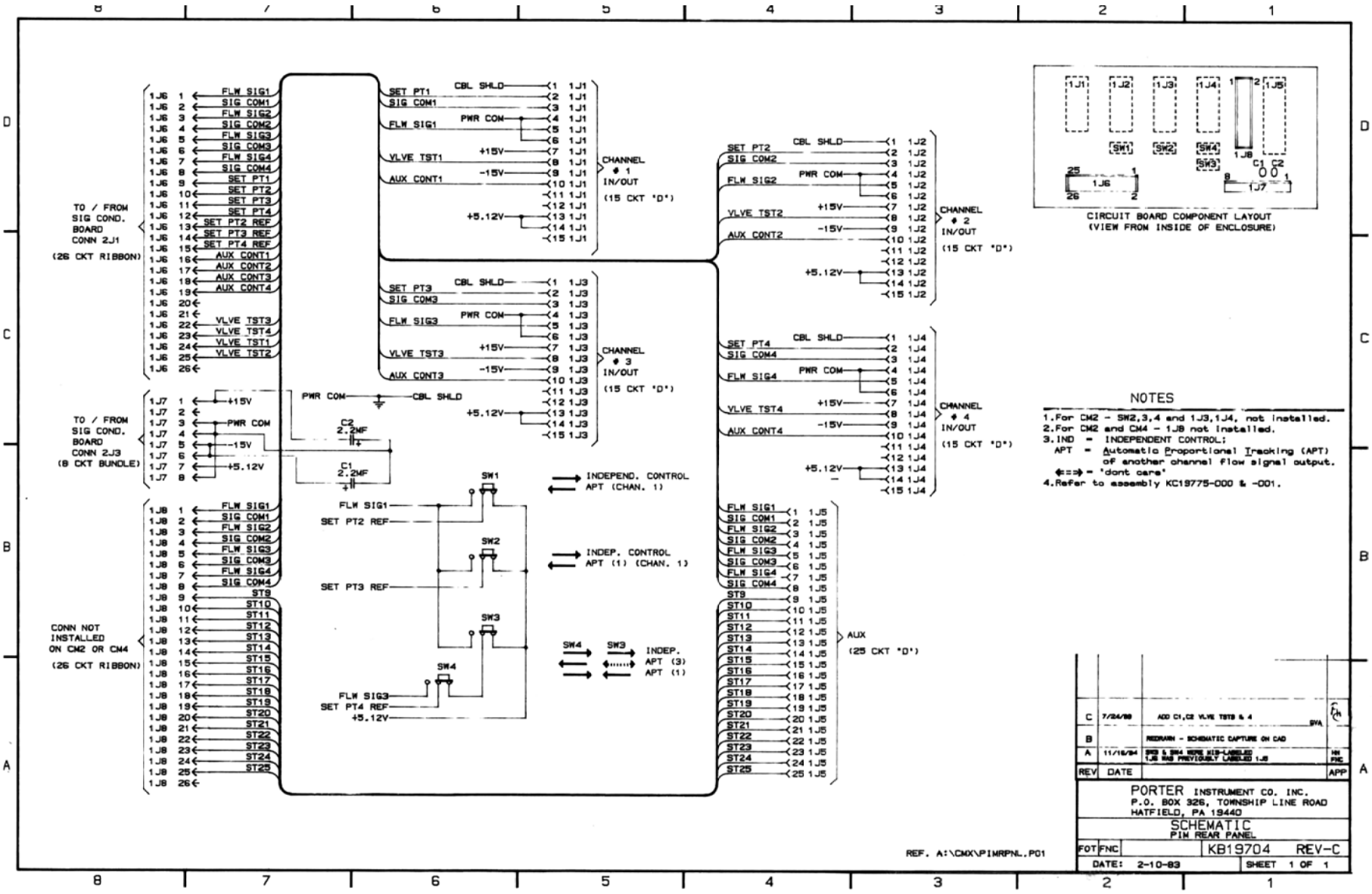
REVISIONS

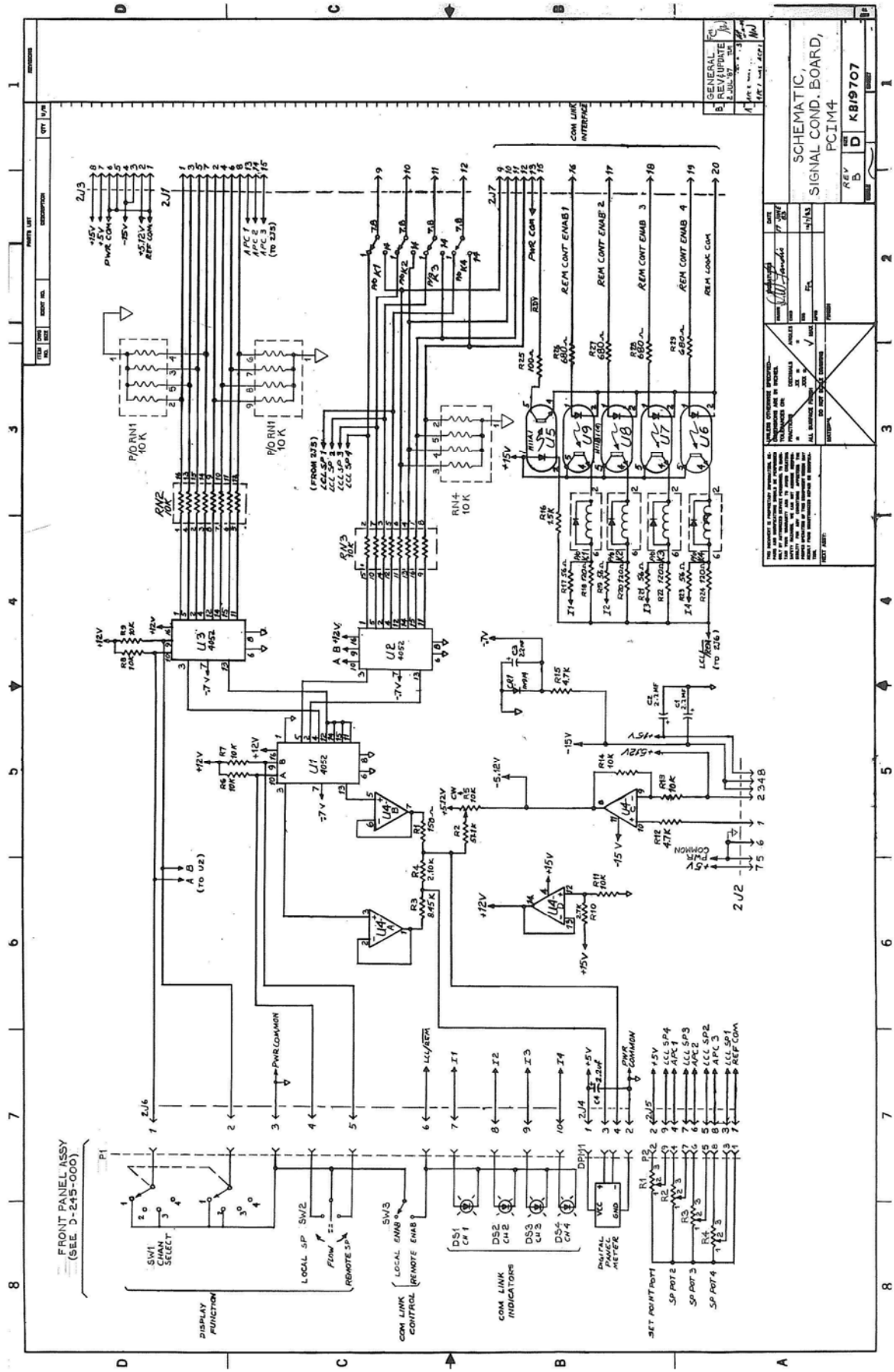
TOLERANCE SPECIFICATIONS UNLESS OTHERWISE NOTED:
1. DECIMAL .XXX .....±.005
2. DECIMAL .XX .....±.02
3. ANGLES .....±2°
4. ALL DIA CONCENTRIC WITHIN .005 T.I.R.
5. 63 RMS FINISH ALL SURFACES
6. BREAK ALL CORNERS .005/.025 X 45°
7. ALL INSIDE CORNERS .005/.025 X R.
8. REMOVE ALL BURRS & SHARP EDGES

PORTER INSTRUMENT COMPANY, INC.
245 TOWNSHIP LINE RD, P.O. BOX 907
HATFIELD, PA 19440-0907, USA

P.C. BOARD ASSEMBLY
POWER SUPPLY

DATE NOV. 28, 1988	FILENAME:	NUMBER	REV
DR. GREGG V.A.	0083520G	KB20001	G
CH. NNW			
APP. FNC	SCALE 2=1	SH 1 OF 2	


TO / FROM SIG COND. BOARD CONN 2J1 (26 CKT RIBBON)
TO / FROM SIG COND. BOARD CONN 2J3 (8 CKT BUNDLE)
CONN NOT INSTALLED ON CM2 OR CM4 (26 CKT RIBBON)
CHANNEL # 1 IN/OUT (15 CKT "D")
CHANNEL # 2 IN/OUT (15 CKT "D")
CHANNEL # 3 IN/OUT (15 CKT "D")
CHANNEL # 4 IN/OUT (15 CKT "D")
AUX (25 CKT "D")
INDEPEND. CONTROL APT (CHAN. 1)
INDEP. CONTROL APT (1) (CHAN. 1)
INDEP. APT (3) APT (1)
CIRCUIT BOARD COMPONENT LAYOUT (VIEW FROM INSIDE OF ENCLOSURE)
NOTES
1.For CM2 - SW2,3,4 and 1J3,1J4, not installed.
2.For CM2 and CM4 - 1J8 not installed.
3.IND = INDEPENDENT CONTROL;
APT = Automatic Proportional Tracking (APT) of another channel flow signal output.
⇐⇒ = 'dont care'
4.Refer to assembly KC19775-000 & -001.
REF. A:\CMX\PIMRPNL.P01
PORTER INSTRUMENT CO. INC.
P.O. BOX 326, TOWNSHIP LINE ROAD
HATFIELD, PA 19440
SCHEMATIC
PIM REAR PANEL
KB19704 REV-C
DATE: 2-10-83
SHEET 1 OF 1


SCHEMATIC,
SIGNAL COND. BOARD,
PCIM4
K8I9707
REV B
FRONT PANEL ASSY
(SEE D-245-000)
DISPLAY FUNCTION
SW1 CHAN SELECT
SW2
SW3
LOCAL SP
REMOTE SP
LOCAL ENAB
REMOTE ENAB
COM LINK CONTROL
DS1 CH 1
DS2 CH 2
DS3 CH 3
DS4 CH 4
COM LINK INDICATORS
DIGITAL PANEL METER
SET POINT POT1
SP POT 2
SP POT 3
SP POT 4
COM LINK INTERFACE
REM CONT ENAB 1
REM CONT ENAB 2
REM CONT ENAB 3
REM CONT ENAB 4
REM LOOK COM
PWR COM
+15V PWR COM
-15V PWR COM
+12V REF COM
APC 1
APC 2
APC 3
(TO J25)
P/O RN1 10 K
RN2 10K
RN3 10K
RN4 10K
U1 4052
U2 4052
U3 4052
U4 LM324
U5 MAX
U6
U7
U8
U9
PWR COMMON
LCL/REM
I1
I2
I3
I4
REF COM
LCL SP1
LCL SP2
LCL SP3
LCL SP4
(TO J26)
(TO J2)
(TO J6)
(TO J4)
(TO J5)
COMMON